Air Force Personnel Center

Predictive Validity of Aptitude and Personality Measures for Sensor Operator Training Outcomes

DoD HFE TAG
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Dr. Mark R. Rose and Dr. Laura G. Barron AFPC/DSYX

Dr. Thomas R. Carretta

711 HPW/RHCI

Outline

- Background
- Current Study
- Predictive Validity: Current Selection Methods
  - ASVAB MAGE Scores
- Predictive Validity: Alternative Selection Methods
  - ASVAB Subtests/TAPAS
- Overlap in RPA Sensor Operator (SO) and RPA Pilot Skills, Abilities, & Other Characteristics (SAOCs)
- Next Steps

Background

- Demand for RPA support has grown dramatically over the last decade
- 2009: USAF created an SO career field (1U0X1) and established SO training sequence
  - Aircrew Fundamentals
  - Basic Sensor Operator Course
  - Certification Training
  - Advanced Training (e.g., Launch and Recovery)

Background (Cont'd)

- **No predictive validity studies for RPA Sensor Operators (SOs) to date**
- **Job analysis studies suggest overlap in required RPA pilot and SO skills, abilities, and other characteristics (SAOCs)**
  - **Perceptual Speed**
  - **Control Precision**
  - **Spatial**
  - **Timesharing**
  - **Assertiveness**
  - **Stress Tolerance**

Current Study Purpose

- First of series evaluating different measures and criteria
- Evaluate predictive validity of pre-accession scores for Basic Sensor Operator Course (BSOC) grades
  - AF classification composites (Mechanical, Administrative, General, & Electronics [MAGE})
    - Current MAGE entry requirement: G ≥ 64 or E ≥ 54
  - ASVAB subtests
  - Non-cognitive measures
- Compare evidence found for SO SAOCs with previous subject matter expert

BSOC Criterion

- **Basic Sensor Operator Course (BSOC)**
  - **3-level AFSC awarding course**
  - **Required to attend Field Training Unit (FTU) initial qualification course**
  - **Course of instruction includes aviation safety, crew resource management, types of sensors, full motion video and heads-up displays, joint ops, etc.**
- **Criterion for this study: BSOC Academic Test Scores**
  - **Average test scores across all blocks of BSOC participated in**

Predictive Validity: MAGE/Current Selection Methods (n = 461)

MAGE Composite	Mean	*SD*	Uncorrected *r*	Corrected *r*
Mechanical	68.99	19.04	.336	.539
Administrative	73.42	14.06	.207	.467
General*	70.87	16.35	.261	.499
Electronic*	75.97	14.23	.244	.490

Currently used for entry into SO career field

he last column values were corrected for range restriction (Lawley, 1943

Predictive Validity: Alternative Selection Methods ($p < .05$)

	N	Mean	*SD*	Uncorrected *r*	Corrected *r*
Arithmetic Reasoning	461	56.79	60.06	.247	.482
Auto and Shop Information	461	51.74	8.51	.282	.412
Electronics Information	458	56.08	7.83	.207	.431
General Science	461	56.36	6.15	.119	.403
Mechanical Comprehension	461	57.66	7.56	.257	.447
Math Knowledge	458	58.29	5.15	.135	.402
Verbal Expression	461	54.90	5.20	.210	.465

Predictive Validity for BSOC: Regression Weighted Composites

- **Development Sample (2011/2012)**

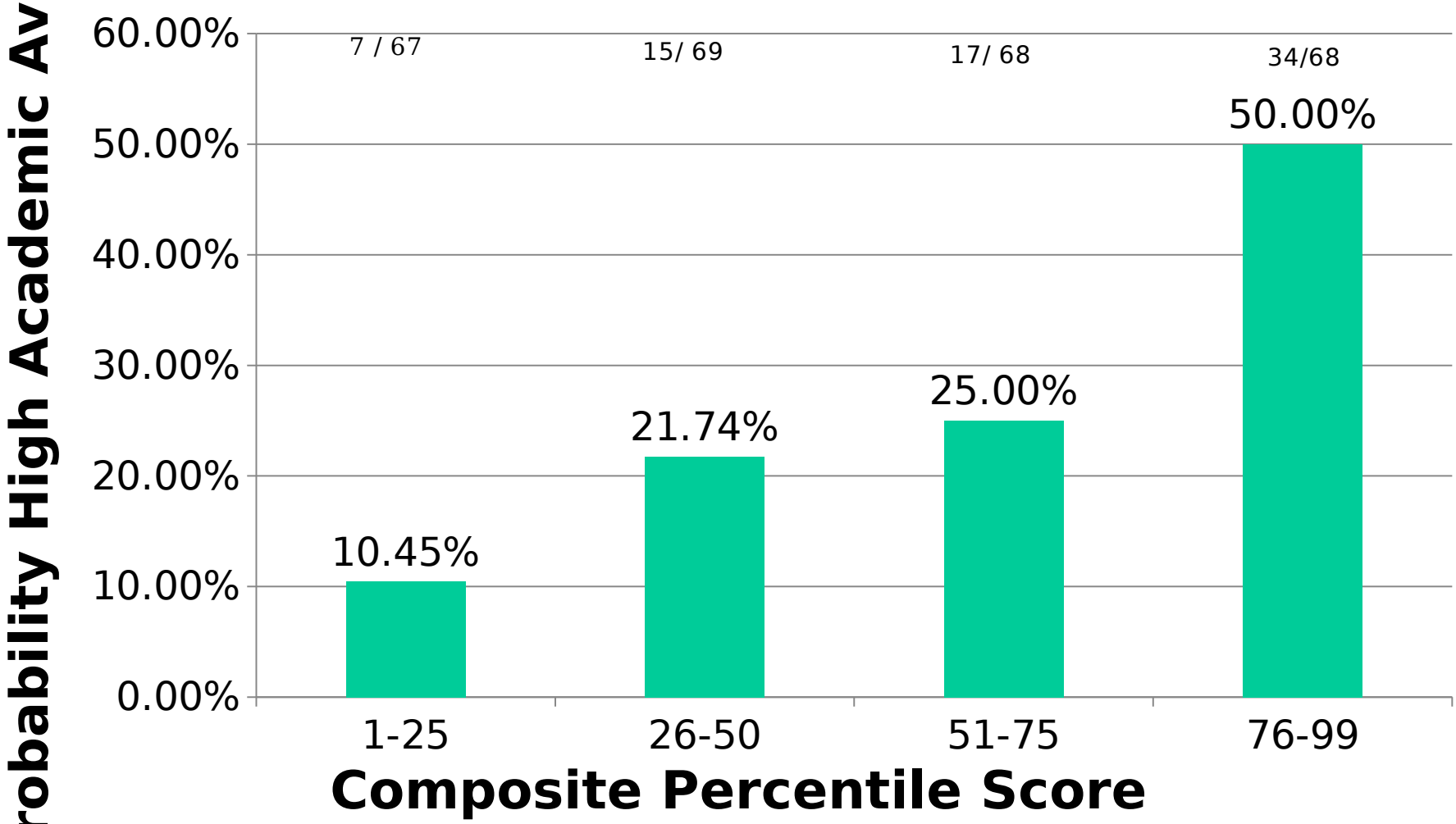
	N	*R*	R^2
ASVAB Subtest Equation	270	.358***	.128

- **Holdout Sample (2013)**

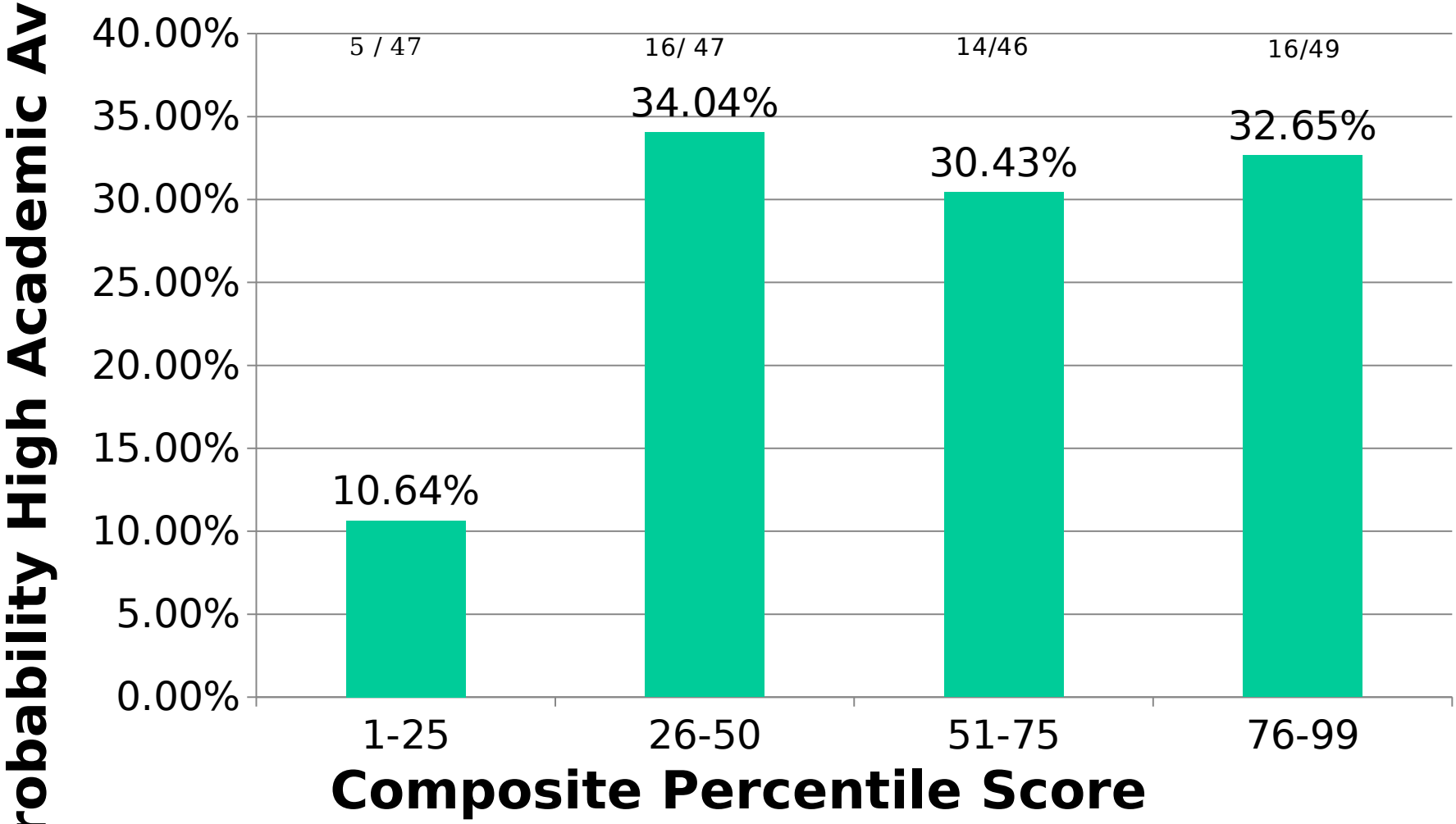
	N	*R*	R^2
ASVAB Subtest Equation	189	.379***	.144

*** $p<.001$

Probability of Finishing with High Academic Average by ASVAB Composite Quartile: Development Sample (*n* = 272)



Probability of Finishing with High Academic Average by ASVAB Composite Quartile: Holdout Sample (*n* = 189)



Significant Predictors for Other SO Training Courses

	MQ1-IQRT	MQ9TX
Cognitive	Arithmetic Reasoning	Arithmetic Reasoning
	Assembling Objects	Assembling Objects
	Auto and Shop Information	Auto and Shop Information
	Electronics Information	Electronics Information
	General Science	
	Math Knowledge	
	Mechanical Comprehension	Mechanical Comprehension
	Verbal Expression	Verbal Expression
Non-Cognitive	Physical Conditioning	Achievement
		Dominance
		Intellectual Efficiency

MQ1-IQRT = MQ1 Initial Qualification and Requalification Training

MQ9TX = MQ9 Basic Training Course

RPA Operator Requirements & SAOCs

- **Several studies have been conducted to identify RPA job requirements and the SAOCs needed to perform those duties**
- **HumRRO, under contract to AFPC/DSYX, reviewed the literature. Primary sources included:**
  - **Mission essential competencies for Predator, Reaper, & Global Hawk RPAs**
  - **USAFSAM job analysis for Predator RPA pilots & SOs**
  - **UK RAF job analysis for Predator RPA pilots & SOs**
  - **Front-end analyses of Predator pilot and SO job requirements**
- **SME reviews indicated very similar SAOC requirements for RPA pilots and SOs, and for pilots of manned aircraft**

SAOCs Judged to be Most Critical for RPA Pilots & SOs (Paullin, et al., 2011)

Skills	Abilities	Non-Cognitive
Critical Thinking	Oral Comprehension	Initiative
Judgment & Decision-Making	Oral Expression	Assertiveness
Teamwork	Number Facility	Decisiveness
	Working Memory	Self-Control
	Task Prioritization	Stress Tolerance
	Selective Attention	Adaptability
	Time Sharing	
	Perceptual Speed	
	Spatial Orientation	
	Visualization	
	Pattern Recognition	
	Control Precision	
	Situational Awareness	

SAOCs Supported for SOs in Current Study (Bold/Underlined)

Skills	Abilities	Non-Cognitive
Critical Thinking	Oral Comprehension	**Initiative**
Judgment & Decision-Making	Oral Expression	**Assertiveness**
Teamwork	**Number Facility**	Decisiveness
	Working Memory	Self-Control
	Task Prioritization	Stress Tolerance
	Selective Attention	Adaptability
	Time Sharing	
	Perceptual Speed	
	Spatial Orientation	
	Visualization	
	Pattern Recognition	
	Control Precision	
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Overlap in RPA Pilot and SO Predictors: Summary

- **Supported need for:**
  - **Spatial Orientation/Visualization**
    - **ASVAB Assembling Objects**
  - **Number Facility**
    - **ASVAB Math Knowledge and Arithmetic Reasoning**
  - **Initiative and Assertiveness**
    - **TAPAS Achievement and Dominance Measures**
- **Partial Support for:**
  - **Critical Thinking/Judgment**
    - **ASVAB Arithmetic Reasoning, Mechanical Comprehension; TAPAS Intellectual Efficiency**

Overlap in RPA Pilot and SO Predictors: Current Study (Cont'd)

- **Potential Additions**
  - **Auto and Shop Information**
  - **Mechanical Comprehension**
  - **Verbal Expression**
  - **Electronics Information**

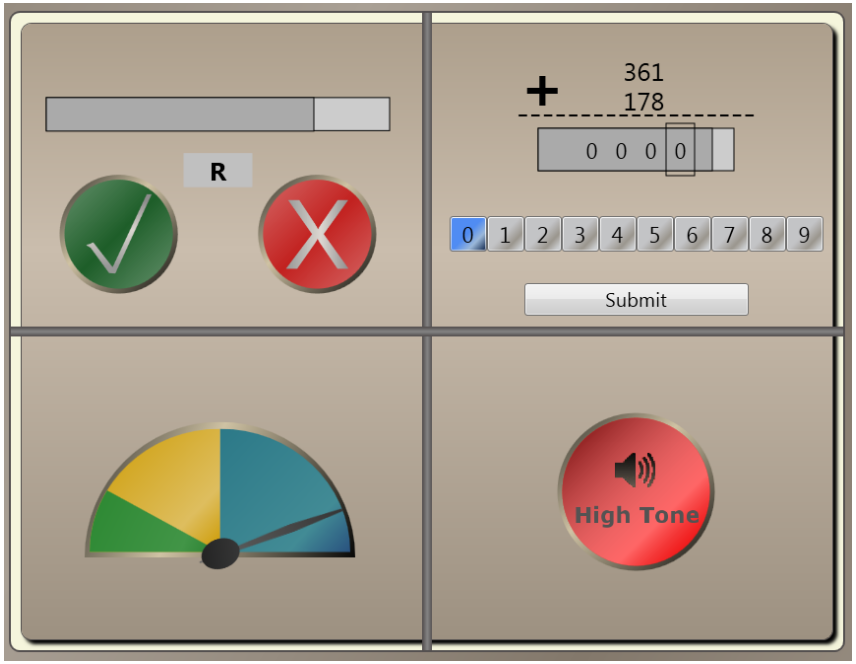
Next Steps

- **Continue development of new measures to address construct gaps**
  - **AF MultiTasking Test**
  - **RPA Person-environment (P-E) fit**
- **Conduct additional predictive validation studies**
  - **Examine generalizability of results as additional students complete BSOC**
  - **Evaluate utility of measures not currently completed pre-accession by enlisted applicants**
    - **Test of Basic Aviation Skills (TBAS)**
  - **Evaluate utility of additional training & post-training performance criteria**

Backup Slides

Recommended New Selection Measures: Multi-Tasking Test

- Multi-Tasking Test (MTT) uses Navy SYNWYN architecture
- Combines 4 simple tasks that the participant must perform simultaneously
  - Memorization
  - Basic Math Skills
  - Visual Monitoring
  - Listening
- Requires attention to all 4 tasks; switching among them to maximize performance



Recommended New Selection Measures: Person-Environment (P-E) Fit

- **Work context factors likely to be promising as an addition to current personnel attribute measures that focus on ability (AFOQT, ASVAB, TBAS) & personality (SDI+, TAPAS, NCAPS)**
- **HumRRO developed a Person-Environment (P-E) Fit measure**
  - **Focused on factors unique to RPA environment**
  - **Development process involved review of existing instruments and reports, discussions with RPA SMEs**
  - **Initial scale development has been completed; currently colleting data for psychometric evaluation**

Tailored Adaptive Personality Assessment Scales (TAPAS)

- Developed under contract by Army Research Institute
- Broad assessment of personality traits related to performance in military specialties
  - 15 traits measured
- State-of-the-art personality test
  - Adaptive
    - Minimizes testing time, item exposure, and test compromise potential
  - Designed to prevent “gaming the test”
    - Each item consists of two statements, balanced in social desirability; respondent picks statement that is "more like me.”
- Other advantages
  - Proprietary to DoD, secure
  - Free to AF
  - Already administered in MEPS